SPECIFICATIONS
FOR
SANITARY SEWER, STORM SEWER
AND APPURTENANCES

CITY OF MAPLE GROVE, MINNESOTA

JANUARY 2016

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SPECIFICATIONS
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AND APPURTENANCES

CITY OF MAPLE GROVE, MINNESOTA

1) GENERAL

The intent of these specification requirements is to provide the requirements for sanitary and storm sewer construction in the City of Maple Grove, Minnesota.

2) LOCATION

The Sanitary Sewer, Storm Sewer and appurtenances to be constructed and installed under this contract are located in the City of Maple Grove, Hennepin County, Minnesota, as shown on the drawings.

3) SCOPE OF WORK

The work to be done under this contract shall include the furnishing of all material, labor, tools, and equipment to construct, complete and in place, the sewer and all appurtenances as shown on the drawings and as specified herein and in accordance with all pertinent requirements of the Minnesota Pollution Control Agency and Minnesota Department of Health.

4) MATERIALS

The materials used in this work shall be new, and conform to the requirements for class, kind, size and material as specified below. Submit in writing a list of materials showing the manufacturer and designation of materials. This list must be approved by the Engineer.

a. REINFORCED CONCRETE PIPE (RCP)

Reinforced concrete pipe and fittings including bends, tee sections and specials shall conform to the requirements of MnDOT Standard Specification for Reinforced Concrete Pipe (3236) and sealed in accordance with MnDOT Standard Plate 3006 and the Standard Specification for Reinforced Concrete Sewer Pipe, ASTM Designation C76 Wall B with circular reinforcing for the class of pipe specified.

Other sizes shall be the pipe class specified on the plans or as recommended by the pipe supplier with approval from the Engineer.

b. REINFORCED CONCRETE BENDS

Concrete pipe bends called for on the plans shall be 7-1/2 pipe bends with a 4'-0" center line laying length with wall thicknesses and steel reinforcing in accordance with ASTM Specifications C76.

c. SANITARY SEWER SERVICE WYES IN RCP

Sanitary sewer service wyes in RCP shall be the core "n" tee rubber boot installed at the factory unless approved by the Owner. Fabricate the rubber boot so as the rubber stop inside the boot that keeps the service pipe from pushing into the mainline falls within the area of the inside wall of the pipe to the area of the outside wall of the pipe. No cast iron bell inserts shall be used.

d. DUCTILE IRON PIPE (DIP)

Design ductile iron pipe for a minimum working pressure of 150 pounds per square inch and shall conform to the applicable dimensions, weights and tolerances of Federal Specification WW-P-421b for cast iron pipe. Ductile iron shall be Grade 60-42-10 with 40/90 metal strength and tested in accordance with ASTM Specification A339-55. Pipe shall be cement lined inside and tar coated outside. The class of ductile iron pipe shall be as specified by the Engineer.

e. POLYVINYL CHLORIDE SEWER PIPE (PVC)

In cuts deeper than 20' use chart below for pipe size and pipe type.

Pipe Size	Pipe Type
8"-15"	SDR 26

In cuts less than 20' use chart below for pipe size and pipe type.

Pipe Size	Pipe Type
8"-15"	SDR 35

The design, dimensions and wall thickness shall conform to ASTM Standard Specifications D-3034. 18" through 48" diameter pipe must conform to AWWA C-905 and Dimension Ratio (DR) 18.

*For 4" through 6" service pipe use Schedule 40 PVC on all depths.

f. CORRUGATED POLYETHYLENE PIPE SEWER

This work shall consist of furnishing and installing dual-wall, smooth interior, corrugated polyethylene pipe and fittings.

(CP) pipe and fittings shall be manufactured from high-density polyethylene (HDPE) virgin compounds. Clean reworked HDPE materials from the manufacturer's own production may be used by the manufacturer of HDPE pipe.

Couplings and Connections shall be made with bell and spigot joints. Bell and spigot joints shall use a gasket if necessary to make the joint soil-tight.

When a watertight joint is specified in the Plans, it shall be required that the joint meet the requirements of ASTM D3212 except as modified. The internal pressure test shall be performed at 68 kPa (10 psi) (minimum) with the pipe in straight alignment. The vacuum test is not required.

Each pipe shall be identified with the manufacturer's name, trade name, or trademark and code from plant location, machine and date of manufacture; nominal pipe size in inches; Ring Stiffness Constant Classification; and ASTM F894.

Pipe to be N-12 as manufactured by Advanced Drainage Systems or Owner approved equal. Pipe lengths shall be 20 foot in length. Pipe shall be cemented into manhole doghouse. All polyethylene pipe crossings shall be minimum of 4 feet in depth otherwise RCP shall be installed.

g. HIGH DENSITY EXTRA-HIGH MOLECULAR WEIGHT POLYETHYLENE (HDPE) PIPE

i. Thermal Butt-Fusion Method of joining.
ii. NSF: Standard No. 14.
iii. PPI Designation: PE 3408.
iv. Cell Classifications: ASTM D3350-PE 345444C.

v. Material Description: ASTM D3350-Type III, Grade PE 34.
vi. Color: Black
vii. Continuously mark pipe with the following information.
    i. Size and dimensions
    ii. Name of manufacturer
    iii. Cell class
    iv. ASTM basis
    v. Pipe test category
    vi. Plant identification
    vii. Production data
    viii. Operator number
    ix. Resin supplier code
viii. Manufacturer

All Solid Wall HDPE pipe shall conform to ASTM D3350, D3035, ASTM F714 and AWWA.

h. STEEL CASING PIPE FOR JACKING – BORING

Steel casing pipe for jacking-boring shall conform to ASTM Designation A252, Grade 2 or ASTM Designation A139, Grade B. The casing pipe shall have minimum thickness as follows:

NOMINAL CASING SIZE	OUTSIDE DIAMETER (INCHES)	MINIMUM SHELL THICKNESS (INCHES)
12	12 ¾	.250
14	14	.282
16	16	.282
18	18	.312
20	20	.343
22	22	.375
24	24	.403
26	26	.438
28	28	.469
30	30	.469
32	32	.500
34	34	.532
36	36	.532
38	39	.563
40	40	.563
42	42	.563

5) JOINTING MATERIAL

The jointing material for type of pipe specified here shall be as follows:

a. REINFORCED CONCRETE PIPE

Reinforced concrete pipe joints shall be in accordance with ASTM C443 with pre-lubricated profile type gaskets.

b. DUCTILE IRON PIPE

Ductile iron pipe joints shall be of the push-on type which comply with AWWA Specification C-111 latest revision.

c. POLYVINYL CHLORIDE PIPE

Polyvinyl chloride pipe joints shall be the bell and spigot type using rubber gasket push-on type joints supplied by the pipe manufacturer and installed according to his instructions, for mainline sewer. Shall conform to ASTM D3212.

For polyvinyl chloride pipe joints on service pipe, risers or bends, use the glue on joint as required for Schedule 40 pipe.

d. POLYETHYLENE PIPE

Polyethylene pipe joints shall consist of a bell and spigot type joint with a prelubricated profile gasket meeting ASTM F477 placed on the spigot end. At least two (2) corrugations of the spigot end must insert into the bell end.

6) MANHOLES AND CATCH BASINS

Construct manholes and catch basins using pre-cast sections conforming to or greater than ASTM Specification C478. All manhole section joints shall conform to ASTM C443 with pre-lubricated profile type rubber gaskets including the joint connection for the top section and top slabs for pre-cast catch basin manholes.

Supply sanitary sewer manholes with pre-formed inverts and flexible sleeve connections for lateral lines 15" in diameter or less unless noted on the construction plans. The flexible connection shall be an interpace boot manufactured by Elk River Concrete, Kore-N-Seal Boot

manufactured by North Star Concrete, Royal Concrete Pipe A-lock pipe to manhole connector or approved equal. No speed crete will be allowed for manhole sealing.

Where shown on the drawings, storm sewer manholes may be built using blocks laid up on full mortar beds and completely fill vertical joints filled with mortar. Shape the base of the unit to form a smooth transition section from inlet to outlet formed directly in the concrete or built up of brickwork and mortar.

In sanitary manholes where no mechanical boots are installed, use PVC manhole adaptors that allow a good bond between concrete and PVC as produced by GPK products or an approved equal. The minimum height of a cone section shall be four (4) feet unless approved by the Owner.

a. FRAMES AND COVERS

The standard manhole casting shall be Neenah Foundry No. R1642-B, or approved equal, as shown on the standard plate and have two concealed pick holes. The minimum allowable weight shall be 360 pounds.

The standard catch basin casting shall be Neenah Foundry No. R3067-V and R3067-VB (low points), or approved equal, as shown on the standard plate.

b. MANHOLE STEPS

Make aluminum manhole steps of Apex Ternalloy No. 5 aluminum alloy. Copolymer Polypropylene plastic manhole steps (PS1-PF) may be used or equal.

c. MORTAR

Mortar shall conform to the requirements of MnDOT 2506.B2.

d. PRE-CAST SEGMENTAL BLOCK

8" pre-cast segmental radial block may be used for the lower portion of manhole over large diameter pipe and for shallow manholes and catch basins as approved by the Owner. Concrete used in the manufacture of blocks shall conform to the requirements of ASTM C139 "Specifications for Concrete &

Masonry Units for Construction of Catch Basins & Manholes". Plaster the exterior of block manholes with one-half inch (1/2") of mortar.

e. CONCRETE

Concrete used shall be composed of a mixture of fine and coarse aggregate and a Portland Hydraulic Cement conforming to the ASTM Specification Designation C-150, Type 1, with the proper water-cement ratio to obtain a concrete testing not less than 3,000 pounds per square inch in 28 days.

7) EXCAVATION AND TRENCH PREPARATION

a. CLASS OF BEDDING

Class B, C-1, or C-2bedding as shown on the standard detail plate SS-14 & SS-15, shall be used as directed on the plans or specified in the special provisions. Bed PVC pipe in accordance with the specifications described below. Special bedding shall be in accordance with the special provisions.

i. POLYVINYL CHLORIDE PIPE (PVC) SEWER PIPE.

Install and bed PVC pipe in accordance with ASTM Specification D-2321, and as shown in standard plate SS-15.

ii. POLYETHYLENE PIPE

Backfill shall consist of native or select type A, B or C granular material as outlined in ASTM D-2321.

iii. ACHIEVE CLASS B CLASS BEDDING

Compacted backfill in the "pipe zone". Bed the pipe in compacted crushed rock or pea gravel placed on a flat trench bottom. The bedding shall have a minimum thickness of 1/4 the outside pipe diameter and extend halfway up the pipe barrel at the sides. Fill the remainder of the side fills and a minimum depth of twelve inches (12") over the top of the pipe with compacted granular selected material.

iv. ACHIEVE CLASS C BEDDING

Shall be achieved by bedding the pipe with care in an earth foundation formed in the trench bottom by a shaped excavation which will fit the pipe barrel with for a width of at least 50% of the outside pipe diameter. Fill the sides and area over the pipe to a minimum depth of six inches (6") above the top of the pipe with compacted normal fill material.

b. CORRECTING FAULTY GRADE

Correct part of the trench excavated below grade with approved material and thoroughly compact without additional compensation.

c. PIPE FOUNDATION IN POOR SOIL

If, in the opinion of the Contractor, the material below the pipe is too soft to adequately support the pipe, the Contractor shall immediately inform the Engineer. When the bottom at subgrade is soft and in the opinion of the Engineer or representative of the Owner, cannot adequately support the pipe, excavate a further depth and/or width and refill to pipe foundation grade with approved material and thoroughly compact to assure a firm foundation for the pipe with extra compensation allowed as provided elsewhere in these specifications.

8) LAYING OF PIPE

Plug the downstream invert of the first existing manhole downstream of the pipe under construction until the system is finalized. Proceed pipe laying with the tongue or spigot ends pointed in the direction of flow. The laying of pipe shall conform to the class of bedding specified. Pipe shall not be laid in water or when the trench conditions are unsuitable for work except by written permission of the Engineer. Complete the excavation of trenches a sufficient distance in advance of the pipe laying and protect the exposed ends of all pipe with a board or approved stopper to prevent earth or substances from entering the pipe.

Carefully clean the interior of the sewer from dirt, cement, or superfluous material of every description as the work progresses. If necessary,

thoroughly flush pipe at the completion of the work at the expense of the Contractor as directed by the Engineer.

a. PIPE ALIGNMENT AND GRADE

Lay and maintain pipe to the required lines and grades, with manholes, catch basins and fittings at the required locations. The owner will furnish one set of line and grade stakes for the work. It shall be the Contractor's responsibility to preserve stakes from loss or displacement. The Engineer may replace stakes he

b. TYPE, SIZE AND CLASS OF PIPE

The type, size and class of pipe installed shall be in conformance with that specified. 12" reinforced concrete pipe is not allowed for storm sewer unless approved by the Owner.

c. CLEANING PIPE

Remove foreign matter or dirt from the inside of the pipe before it is lowered into position in the trench, and keep clean by approved means during and after laying..

d. GRADE CONTROL

Maintain the line and grade of the pipe in the trench by laser method. If the laser is correctly set and the error is yet apparent, notify the Engineer immediately so that the staking may be checked.

9) SANITARY SEWER SERVICE HOUSE CONNECTIONS, WYES

As indicated on the plans and at points as deemed necessary, install six inch (6") or four inch (4") HWS SDR 26 wyes with Schedule 40 glue on branch for house connections in the center of each lot unless otherwise specified. Fernco fittings will not be allowed. All sewer bends and service risers shall be heavy wall pipe such as Schedule 40. If necessary, a 45˚ bend shall be installed to bring the end of the service to the elevation of the water curb stop or 7-1/2 feet below grade. Make the joints and bedding as previously specified. Cap the end of the service pipe and openings to wye and/or tee branches to prevent water from entering the service until the connection is placed in service.

a. RECORD AND LOCATION OF SERVICE CONNECTIONS

It shall be the duty of the Contractor to cooperate with the Owner to keep accurate records of service connections to location, depth to top of riser, type of connection provided, etc. Locate to the nearest downstream manhole from the service. Turn this record over to the Engineer for his records at time intervals specified by the Engineer. All services, bends, tees or connections shall have a GPS shot of their location done by the Contractor within the tolerance of 4" (inches).

At the end of house connections, furnish and set a two inch by two inch (2"x2") wooden marker stake set vertically extending from the invert of the service stub to two feet (2') above the ground surface.

10) SUMP DRAIN CLEANOUT, AND SUMP DRAIN INLET

This shall include all work necessary to provide sump pump drains as indicated in the plan. This work shall include, but not be limited to all equipment, labor, and materials necessary to complete the work as specified.

Cleanouts shall be installed at all dead ends, on all services, directly behind the catch basin after the bends and locations in lengths of pipe greater than 200-ft for maintenance purposes.

When the mainline is attached to the catch basin or manhole a rodent guard that swivels up to allow trash to pass through shall be installed.

Services installed under roadways shall be insulated with 4" insulation (4'x8'x2" sheets). Granular bedding shall be used under the insulation where clay soils exist.

Service inlets shall include a 1.5' stub beyond the curb or walk (whichever is greater) and capped and marked as indicated on Standard Plate STS-9. Services shall include the tee, pipe, cap and marker.

Any tees or bends installed with the main line piping shall be incidental mainline pipe drain.

Tracer wires shall be laid with the pipe and shall be #12 AWG Solid (0.0808" diameter), 21% conductivity copper-clad hard drawn high carbon steel extra high strength horizontal directional drill tracer wire, 1150 pound average tensile break load, 45mil. The conductor insulator shall consist of a high molecular weight-high density yellow polyethylene jacket complying with ASTM-D-1248, 30 volt rating. Termination of the tracer wire shall be at all clean outs and storm sewer structures. The tracer wire shall be incidental to the sump drain installation.

The terminations shall reflect Standard Plate STS-8 tracer wire access box and shall be installed 3"-6" below finish grade elevation. When connecting near a catch basin, the termination cap will be 3"-6" behind the back of curb line and in the middle of the 2x3 casting. The Contractor shall provide Valvco type tracer wire access box as approved by the Engineer. This work shall be considered incidental.

Tracer Wires shall be tested for electrical continuity. The electrical test shall be made after the entire sewer has been installed and connected at both ends. If the test is a failure the contractor shall make the corrected measures as directed by the engineer and be at no cost to the owner.

Drilled or preformed holes in the drainage structure are required for all connections to minimize structure damage. In addition, the joint is to be mortared both inside and outside of the structure wall where the drainpipe goes into the structure. Rodent screens will be provided at all open ends (i.e. in structures) of the pipe drain. This work shall be considered incidental.

11) SETTING MANHOLES AND CATCH BASINS

a. LOCATION

Locate manholes and catch basins as shown on the Drawings or as directed by the Engineer.

b. CONSTRUCTION DETAILS

The details of construction of individual structures shall conform to the drawings and specifications.. Construct the bottom of manholes of half section of equivalent size pipe shaped to conform to the inlet and outlet pipe to allow an uninterrupted flow.

c. ADJUSTING RINGS AND BLOCKS

Manhole frames and covers shall be set to the designated elevation in a full mortar bed where concrete adjusting rings are approved for use. A concrete collar shall be poured around adjusting rings used to set frames for catch basins. Provide no less than two (2) – two inch (2") adjusting rings and no more than fourteen inches (14") of adjusting rings between frame casting and precast manhole top slab or cone. See standard plate SS-8 for more details.

The final adjustment may be made with a ductile iron adjusting ring but the manhole casting must be sandblasted and ductile ring glued to the casting.

d. Cretex PrO-Ring

i. GENERAL

This specification defines the materials required for the adjustment of all manholes, catch basins or other underground utility structures to final elevation as shown on the project drawings for sections of street with an ADT of 5,000 or greater or on sections of road approved by the engineer in the Special Provisions.

1. WORK REQUIRED

Grade adjustment rings meeting the requirements of this section shall be used to adjust and support the frame and cover or grate to the specified final elevation on all manholes, catch basin or other utility structures.

2. SYSTEM DESCRIPTION

Design Requirements – The grade adjustment rings shall be designed to allow final adjustment of the frame and cover or grate to the grade established by the ENGINEER on the project drawings. The rings shall also be designed to accommodate flat or sloping surfaces to within approximately ¼" (one quarter inch) to ½" (one half inch) of the specified final elevation. The grade adjustment system shall have a minimum 50 (fifty) year design life.

Performance Requirements – The grade adjustment rings shall be capable of supporting the minimum

requirements of ASSHTO H-25 and HS-25, be UV stable and be resistant to chemicals and corrosion commonly associated with the sanitary and storm sewer environments.

3. SUBMITTALS
   Test Report – A test report from an approved third party testing agency showing the grade adjustment rings meets the minimum requirements of ASSHTO H-25 and HS-25.

   Certification – The manufacturer of the grade adjustment rings shall provide certification to the ENGINEER stating that the product meets the design life and material requirements of this specification.

ii. PRODUCTS

MANHOLE AND CATCH BASIN GRADE ADJUSTMENT RING
Manhole and catch basin grade adjustment rings shall consist of a variety of heights (thicknesses), diameters and shapes all conforming to the following requirements:

1. Grade Adjustment Rings – The grade adjustment rings shall be manufactured from ARPRO® Expanded Polypropylene (EPP), black. 5000 series meeting ASTM D3575. The rings shall be manufactured using a high compression molding process to produce a finished density of 120 g/l ((7.5 pcf).

2. "Grade" adjustment rings may contain either an upper and lower keyway (tongue and groove) for vertical alignment and/or an adhesive trench on the underside with a flat top.

3. "Finish" or "Flat" rings may either have a keyway (groove) on the underside for vertical alignment and/or an adhesive trench with a flat upper surface. These rings shall be available in heights (thicknesses) which will allow final adjustment of the frame and cover or grate to within ¼" (one quarter inch) to ½" (one half inch) of the specified final elevation.

"Finish" rings may also have a keyway on the upper surface of the inner diameter to facilitate installation of an "Angle" ring.

4. "Angle" rings may either have an upper and lower keyway (tongue and groove) for vertical alignment and/or an adhesive trench on the underside. When required, the "Angle" ring or rings shall allow final adjustment of the frame and cover or grate to within ¼" (one quarter inch) to ½" (one half inch) of the specified final elevation.

5. Acceptable Manufacturer – PRO-RING™ by Cretex Specialty Products

iii. EQUIPMENT

The contractor shall have the required tools and equipment necessary to facilitate proper installation of the grade adjustment rings.

1. ADHESIVE SEALANT

Any adhesive or sealant used for watertight installation of the manhole grade adjustment rings shall be M-1 Structural Adhesive/Sealant or equal meeting the following specifications:

ASTM C-920, Type S, Grade NS, Class 25, Uses NT, T, M, G, A and O Federal Specification TT-S-00230-C Type II, Class A

Corps of Engineers CRD-C-541, Type II, Class A
Canadian Standards Board CAN 19, 13-M82

AAMA 802.3-08 Type II, AAMA 803.3-08 Type I and AAMA 805.2-08 Group C

Other adhesives or sealants may only be used with engineer or owner's written authorization.

2. REPAIR MORTAR

Repair mortar shall be a one component, quick set, high strength, non-shrink; polymer modified cementitious patching mortar, which has been formulated for vertical or overhead use meeting the requirements of ASTM C-109 for Compressive Strength, C- 348 and C-78 for Flexural Strength and C-882 for Slant Shear Bond Strength. Repair mortar shall not contain any chlorides, gypsums, plasters, iron particles, aluminum powder or gas-forming agents nor shall it promote the corrosion of any steel that it may come in contact with.

3. CEMENTITIOUS GROUT

SCOPE

Cementitious grout shall be a premixed, non-metallic, high strength, non-shrink grout which meets the requirements of ASTM C-191 and C-827 as well as CRD-C-588 and C-621. When mixed to a mortar or "plastic" consistency, it shall have minimum one day and 28 day compressive strength of 6,000 and 9,000 psi, respectively.

iv. EXECUTION

1. INSTALLATION

Installation and surface preparation shall be in accordance with the manufacturer's instructions. The joint between the first grade ring and top of the manhole, catch basin or utility structure shall be sealed using an adhesive/sealant meeting the requirements of Section 2.03.

If the top of the manhole, catch basin or utility structure is not level or is irregular, then a non-shrink repair mortar meeting the requirements of Section 2.04 or non- shrink cementitious grout meeting the requirements of Section 2.05 shall be used. A bed the specified mortar or grout shall be placed on the top surface of the utility structure and then the first grade ring shall be embedded and leveled into the bed of material.

The remaining joints between all manhole adjustment rings and the frame and cover or grate shall be sealed using an adhesive/sealant meeting the requirements of Section 2.03.

No other materials shall be used in the construction of the grade adjustment area beyond those specified above. Prohibited materials include, but are not limited to wood or wood shims of any kind, concrete, brick, block, stones, etc.

The use of any heat shrinkable chimney seals shall not be permitted.

12) MANHOLE DROP SECTIONS

Construct manhole drop sections where shown on the plans according to the detail drawings. No inside drops shall be allowed unless approved by Owner. Install pipes to match flow lines unless an outside drop is constructed.

Drop manholes shall be protected from corrosion by one of the following ways:

a. NEW CONSTRUCTION

i. EMBEDDED LINER

Manhole walls shall be lined with GSE Studliner as manufactured by GSE Environmental, AGRU Sure Grip, or AMER-PLATE T-LOCK as manufactured by Ameron, Inc.

b. EXISTING CONSTRUCTION

i. SPRAY ON POLYMORPHIC RESIN

Effectively protect the exposed concrete surfaces from corrosion in those areas shown on the drawings or specified. The liner shall be continuous and free of pinholes at the joints and in the liner itself.

All work for and in connection with the installation of the lining, field seaming and welding of joints shall be done in

strict conformity with all applicable instructions and recommendations of the liner manufacturer.

c. RISER PIPE

The risers for drop manholes shall consist of D.I.P. or SDR 35 PVC with size matching that of the incoming upstream pipe.

13) TESTING

An infiltration test, where applicable and a low pressure air test will be required on sanitary sewer construction. Consider the cost of testing incidental to the contract project.

a. TESTING OF SEWER LINES PRIOR TO STREET CONSTRUCTION

Complete and have testing accepted on sewer lines prior to the commencement of street construction. Access to the manholes for air testing and lamping will be the Contractor's responsibility.

The Contractor shall notify the Engineer and the City Utility Department 24 hours prior to testing of utilities. The Engineer or a representative from the City Utility Department must witness all utility testing.

b. LOW PRESSURE AIR TESTING

Upon completion of the sewer and before house services are connected to the pipe line, after the line has been backfilled and cleaned, furnish equipment and personnel to conduct a "pipe line acceptability test" using low pressure air. Perform this test between two manholes in succession.

Seal the pipe line with plug whose sealing length is greater than the diameter of the pipe and constructed in a nature that will maintain a seal against the line's test pressure. Cap and brace all wyes, tees, outlet or ends of lateral services to withstand the internal pressures. Caps or plugs shall be easily removable.

Tap one plug for the air supply hose and the return air pressure hose. The air supply hose, connected from the compressor to the plug, shall have a throttling valve, bleeding valve and shut off valve for control. The air pressure tap shall have a sensitive

pressure gauge, 0 to 10 psi range, protected by a gauge cock and a pressure relief valve set at 10 psi.

Add air slowly to the pipe line until pressure inside the pipe line reaches 4.0 psig. If air is added too rapidly, the test accuracy will decrease because a change in temperature also has an effect on the change in pressure. When the air pressure inside the pipe line reaches 4.0 psig above the external hydrostatic pressure the supply air is stopped. Allow a time interval for the temperature difference to stabilize before the actual test is performed. If the air pressure drops below 3.5 psig during this time interval, supply more air to the pipe line and throttle to maintain a pressure between 3.5 psig and 4.0 psig for a minimum of two minutes after which time the supply air will be shut off.

The portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.003 cfm per square foot of interval pipe at an average pressure of 3.0 psig greater than back pressure exerted by ground water that may be over the pipe at the time of test.

Accomplish the test by determining the time in minutes for the pressure to decrease from 3.5 psig to 2.5 psig greater than the average ground water that may be over the pipe. That time shall not be less than the time shown for the diameter in the following table.

Pipe Diameter in Inches	Minutes
4	1.9
6	2.8
8	3.8
10	4.7
12	5.7
15	7.1
18	8.5
21	9.9

If the pipe line fails to meet the requirements of the test, the Contractor shall, at his expense, determine the source of leakage then repair or replace defective material and/or workmanship.

In determining the pressure greater than the average ground water the ground water height in feet above the pipe line must

be measured. When the water elevation has been established, divide the height in feet above the pipe line by 2.31 and that pressure added to gauge pressure of test.

A table for converting water height to gauge pressure is as follows:

Ground Water Level Over Top of Pipe Line	Added Pressure to be Applied to Gauge Pressure Readings
1 Foot	0.43 psig
2 Feet	0.86 psig
3 Feet	1.29 psig
4 Feet	1.72 psig
5 Feet	2.16 psig
6 Feet	2.59 psig
7 Feet	3.01 psig
8 Feet	3.44 psig
9 Feet	3.87 psig
10 Feet	4.30 psig

c. INFILTRATION TEST

If infiltration is detected the contractor shall supply all materials and labor to conduct an infiltration test. The maximum allowable rate of leakage shall be 100 gallons per inch of diameter of pipe per mile for 24 hours.

d. DEFLECTION TEST

The deflection will be checked by means of televising prior to final acceptance of the sanitary sewer and storm sewer lines. Deflections greater than 7.5% of the inside diameter of the pipe shall be considered failure of the bedding procedure. For deflections between 7.5% and 10.0% the Contractor shall have the option of:

i. Determining the extent of the deflections and accepting a reduced payment in accordance with the schedule shown below:

OR

ii. The Contractor shall be required to re-excavate the trench, re-compact the backfill material and restore the surface at

no additional compensation with the re-laid pipe meeting the 7.5% requirement.

Correct deflections greater than 10.0% in accordance with Option 2 stated above. The payment reduction, if exercised, will be applied to the entire length of the pipe between the manholes in which the deflection between 7.5% and 10.0% occurs.

Deflecting	% Reduction in Payment
Less than – 7.5%	0%
7.5% - 8.5%	5%
8.5% - 9.0%	10%
9.0% - 9.5%	15%
9.5% - 10.0%	20%
Greater than 10%	Pipe will be re-laid

e. ADJUST MANHOLE AND TELEVISING

All manholes and castings in paved areas shall be located within 24 hours after paving the non-wear course. All castings shall be raised and adjusted to grade and the sewer lines shall be cleaned within 10 calendar days after placing the bituminous base course. These interim adjustments of appurtenances located within the street shall be between 1/4" and 1/2" below the pavement surface. Interim adjustments are required on all appurtenances located in areas where the permanent wear course will not be paved until the following construction season.

The contractor shall notify the Owner by written documentation when the sewer lines have been completed and cleaned as specified. The Owner will schedule the sanitary sewer lines to be televised after written notification from the Contractor of all completed work to the Sanitary Sewer System. The Owner will schedule and pay for the televising of the sewer lines the first time. However, if the Contractor has not completed the raising, adjusting, cleaning, setting castings and all work, a $500.00 per day penalty will be imposed on the Contractor until such work is complete. If the initial televising fails in any way, the Contractor will pay 100% of the resulting televising required until final acceptance by the Owner.

14) BACKFILLING

Backfill excavation in trenches to the original ground surface or to grades as specified or shown on the plans. Begin the backfilling as soon as practicable after the pipe has been placed. Prior to backfilling, clean the excavation of trash, debris, organic material, and undesirable material. Backfill trenches every night prior to leaving job site. Trenches may be left open with appropriate protection with approval by the Engineer and Owner.

a. BACKFILL PROCEDURE AT THE PIPE ZONE

Backfill and compact as thoroughly as possible to prevent after settlement. Deposit the backfill so the shock of falling material will not damage the pipe or structures. Grade over and around parts of the work as directed by the Engineer.

Deposit suitable material determined by the Engineer, free from rocks and boulders, deposited in the trench simultaneously on both sides of the pipe for the width of the trench to a height above the top of the pipe as specified. Shovel place and hand tamp the pipe bedding material to fill spaces under and adjacent to the pipe. A jumping jack is required to be used along the length of the pipe on both sides. If natural, suitable, granular material is not encountered during the excavation of the trench, or when the material is determined unsuitable by the Engineer, for backfilling around the pipe as required above; provide and place approved material from other sources.

b. BACKFILL PROCEDURE ABOVE THE PIPE ZONE

Unless specified, furnish suitable backfill material and use the following backfill procedures above the "pipe zone" to the existing surface elevation or design grade, as specified

Backfill the trench to obtain compaction, with the lift thickness as required with a maximum of one foot (1') lifts. Compact the backfill material to 95% of the standard moisture density relationship of soils (ASTM D698-70) except the top three feet (3') of the trench which shall be compacted to 100% density.

Backfilling of utilities installed down lot lines shall require material to be compacted to 100 percent of the standard moisture density relationship of soils regardless of depth.

Consider settlements greater than one inch (1") measured with a string line from one edge of the settlement to the other within the warranty period of this contract failure of the mechanical compaction and repair street surfaces, driveways, and boulevard and ditch areas at no cost to the City.

c. DISPOSAL OF EXCESS MATERIALS AND DEBRIS

Unless specified, dispose of excavated material not suitable or not required for fill material within the project limits at the Contractor's expense. If the Engineer deems there is no area in the project limits to dispose of excess material, he shall direct the Contractor to dispose of material off site in a manner subject to the provisions of the following paragraph and the Contractor will be compensated in accordance with the bid unit price in the contract.

Before dumping materials or debris on a private or public land, the Contractor must obtain from the owner of land written permission for dumping and a waiver of claims against the owner for damage to land which may result together with permits required by law for dumping. File a copy of permission, waiver of claims and permit with the Engineer before disposal is made.

d. DENSITY TEST

Density tests will be performed by an approved soils testing firm at locations and depths throughout the project as directed by the Engineer. Cooperate and provide assistance as necessary to complete these tests with no additional compensation to the Contractor.

Testing costs pertaining to passing tests shall be paid for by the Owner. Testing costs pertaining to failing tests will be charged to and paid for by the Contractor.

15) SURFACE RESTORATION, CLEANUP AND GUARANTEE

a. RESTORATION OF SURFACE

Return surfaces disturbed during the construction period to its original condition or better.

b. MAINTENANCE OF STREET UNTIL SURFACED

After backfilling according to the above specifications, maintain the streets as required and blade as necessary to provide a passable surface for traffic until the surfacing is completed or to the date of final acceptance.

c. CLEANING UP

Remove surplus pipe material, tools, and temporary structures and dirt or rubbish caused by Contractor's operations and haul excess earth from excavations to a dump provided by the Contractor, and the construction site in a condition satisfactory to the Engineer.

d. GUARANTEE

The Contractor shall be held responsible for defects in workmanship and materials which may be developed in part of the installation furnished by him and immediately replace upon written notice from the Engineer and make good, without expense to the owner, faulty part or parts and damage done during the period as prescribed in Section 7.8 of the conditions of the contract.

e. FAILURE TO REPLACE DEFECTIVE PARTS

Should the Contractor fail to make good the defective parts within a period of 30 days of written notification the Owner may replace these parts, charging the expense to the Contractor.

16) RIP-RAP MATERIALS

Furnish and install rip-rap as designated by the plans and per Standard Plate STS-7 or as directed by the Engineer to prevent the possibility of erosion. If the rip-rap is not placed per the Standard Plate or by the direction of the Engineer, no payment will be made until it has been corrected and to the Engineers satisfaction.

a. RIP-RAP MATERIALS

The rip-rap material shall conform to Minnesota Department of Transportation Standard Specifications 3601. Field stones may be also be used when approved by the Owner.

b. FILTER BLANKET MATERIAL

Filter blanket material shall conform to MnDOT Spec. 3601.2H, and be placed beneath the rip-rap material at storm sewer outlets.

c. LINER MATERIAL

Place Type 1 geotextile fabric beneath the filter blanket material at storm sewer outlets as described on the standard plate. Liner material shall conform to MnDOT Spec. 3733.

17) METHOD OF PAYMENT

The work shall be measured and the compensation determined in the following manner:

a. SEWER PIPE

Sewer pipe shall be paid for at the contract price per lineal foot, measured from center of manhole to center of manhole, connection to manhole or manhole to the end of the line as specified and shall include the cost of furnishing and installing pipe, pipe bend sections, jointing material, and bedding material at the depth specified. Lengths will be measured in a horizontal plane unless the grade of the pipe is more than 15%. The depth of cut for payment is the distance between the invert of the pipe at a point and the intersection of a vertical or plumb line extended from the point to the intersection of the line with the ground surface as exists at time of construction.

b. MANHOLES

The standard manholes and drop manholes shall be paid for at the contract unit price per each for the depth of 0-8 feet. Payment shall include the cost of furnishing and installing tees, pre-cast sections, sewer block, concrete slabs, adjusting rings, mortar, castings, water proofing, and jointing, excavating, backfilling and dewatering at the depth specified when a bid item is provided, additional payment will be made for manholes installed at depths greater than eight feet (8') at the contract unit price per lineal foot. Manhole over depth shall be measured from the invert of the sewer to the point of eight feet (8') below the rim elevation.

c. Adjusting Manholes

Interim adjustments are required on all manhole castings located in areas where the permanent wear course will not be paved until the following construction season. All interim adjustments are considered incidental.

Manholes requiring an additional adjustment to prior to installation to the final wear course will be paid for at the contract unit price per each.

c. RISERS FOR DROP MANHOLES

The riser pipe, including pipe support, for drop manholes will be paid for at the contract unit price per lineal foot. Length of riser shall be computed as distance from tee invert to invert of lowest pipe entering manhole.

d. WYES, TEES AND SPECIAL FITTINGS

Wyes, tees and special fittings will be paid for at the contract price per each. Tees required for drop manholes are considered incidental to the drop section.

e. CATCH BASINS

Catch basins will be paid for at the contract unit price per each, including base and casting and adjusting rings.

f. FLARED END SECTION IN PLACE

End sections will be paid for at the contract unit price per each for size furnished including placing costs and trash guard. Flared end sections will not be included in the lineal footage of pipe measured.

g. RIP RAP MATERIALS

Rip-rap materials will be paid at the contract unit price per cubic yard. Payment shall include the filter blank and geotextile fabric at the flared end section per Standard Plate STS-7.

h. FOUNDATION MATERIAL

Material used for refilling to pipe foundation grade to assure firm foundation for pipe shall be paid for at the contract unit price per linear foot in 6" depth increments in place regardless of width. Payment shall include cost of excavation and placement.

[END SANITARY SEWER, STORM SEWER]